

*Flatulence**

Carbohydrates, Digestion & Enzymes

The downside of eating high fiber, healthy foods (vegetables & plant protein) → gastrointestinal distress.

* Also known as passing gas, farting, flatus or breaking wind. Fart derives from the Latin word for "wind." "Flatulent" refers to being "liable to, or prolific in, windy blasts,"

<http://www.etenet.com/Apps/Library/>
<http://www.tipsofallsorts.com/flatus.html>

Most people produce about 0.5 liters to 1.5 liters of gas a day and everyone passes gas about 14 times a day on average. It is a natural, but usually unspeakable phenomenon that can occur at any time even when our bodies are relaxed while in bed or in the bathtub. How loud the sound of expelling gas is directly proportional to the volume and pressure of the gas. Some are silent.

It has been reported that it is unwise to withhold the urge to release gas since gas is absorbed into the blood stream and the liver can be overtaxed with recycled gas. However, many people think that they should not have any gas or what they do have needs to be reabsorbed and that any gas is too much.

Gas is made primarily of odorless vapors - carbon dioxide, nitrogen, hydrogen, and methane. The unpleasant odor of flatulence comes from anaerobic fermentation by bacteria in the colon. That "one-of-a-kind smell" comes from trace gases such as hydrogen sulfide, ammonia, indole, skatole and amines such as putrescine and cadaverine that are produced by the person's unique gastrointestinal biota.

Although having gas is common, for most of us it is uncomfortable and embarrassing. The most common ways to reduce the discomfort of gas are changing diet, taking medicines, and reducing the amount of air one swallows.

Diet. A diet that is lactose-free may improve the condition as well as eliminating or reducing certain common gas-producing foods. (See the following table.) Doctors may also suggest limiting high-fat foods to reduce bloating and discomfort. This helps the stomach to empty faster, allowing gas to move into the small intestine.

Nonprescription medicines. Many nonprescription, over-the-counter medicines are available to help reduce symptoms, including antacids with simethicone and activated charcoal. The effectiveness of these medications is unclear. Digestive enzymes, such as lactase supplements, actually help digest carbohydrates and may allow people to eat foods that normally cause gas. *Beano* reduces gas production associated with baked beans and other types of foods which are rich in certain oligosaccharides (complex sugars called RFOs, the Raffinose Family of Oligosaccharides that are not digested in the human gastrointestinal tract. The product contains an enzyme which hydrolyzes the sugars into simpler forms that are absorbed into the bloodstream which avoids their fermentation.

BEANS THROUGHOUT THE AGES

The next time you go to enjoy your favorite bean dish, know that there's a bushel of history behind it: Beans have been elevating mankind not just nutritionally but spiritually for thousands of years. Among the first crops ever cultivated, beans have helped people survive famines, had prominent families named after them, nourished centuries of sailors, and even had temples built in their honor as the symbols of life itself. Here's a closer look at some of the highlights in the long and glorious history of this noble nutritional mainstay.

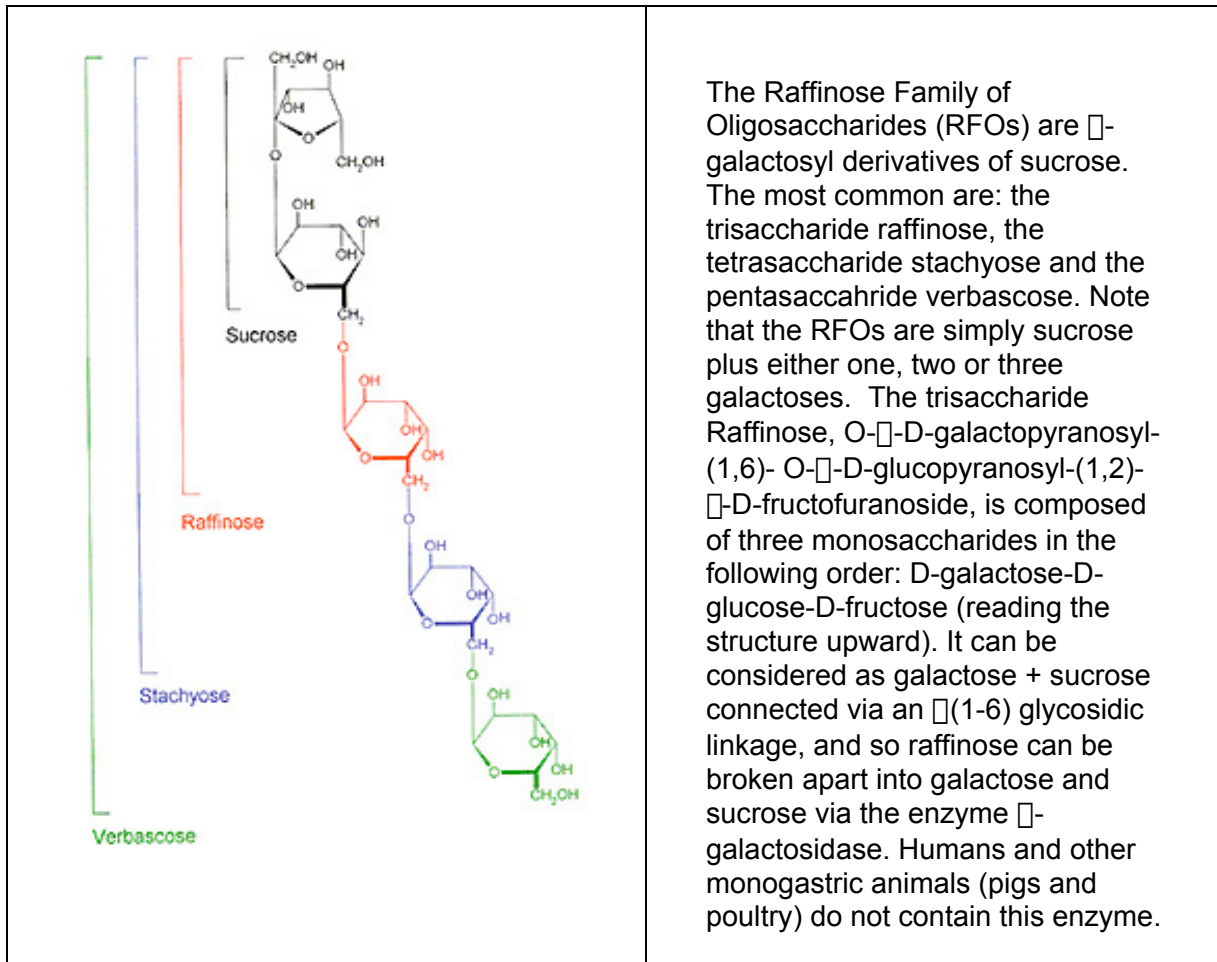
- * When our hunting-and-gathering prehistoric ancestors finally decided to stay in one place long enough to cultivate crops, beans were among the first to be grown.
- * In the first Roman cookbook, written over 2,000 years ago, beans got an entire chapter
- * The four most prominent families in ancient Rome named themselves after beans-the Lentulus (after lentils), the Fabius (after favas), the Ciceros (after chickpeas), and the Pisos (after peas).
- * Beans were used as "ballots" by the ancient Greeks and Romans casting votes in political elections and legal trials.
- * Christopher Columbus took chickpea seeds with him on his voyage to the Caribbean in the 15th century.
- * In the 16th century, dried peas helped the peasant population of England survive a devastating famine.
- * In the 17th century, beans were believed to be a cure for baldness.
- * In the early 1900s, nutritious beans were declared by President Theodore Roosevelt as the reason for the US victory in the Battle of San Juan Hill.
- * During World War II, the US Army floated waterproof bags of beans from ships to beachheads to help nourish American troops.

Use 1 BEANO tablet or five drops of BEANO liquid per serving of problem food (one serving = 1/2 cup) with the first bite of food. A typical meal consists of two or three servings. For best results, you may have to adjust the number of tablets or drops according to your food portions. Too much heat can inactivate the enzyme, so don't cook with BEANO.

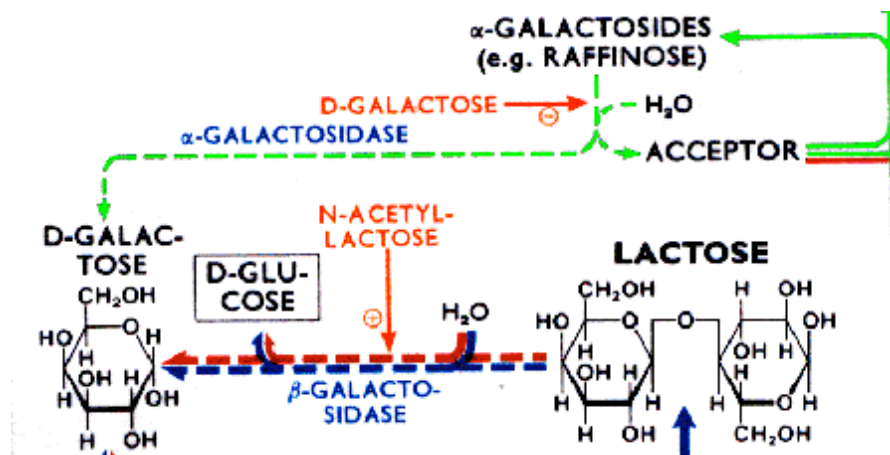
Foods associated with Flatulence

Vegetables	Legumes	Grains/Cereals/Seeds/Nuts	Others
Beets	Black-eyed peas	Barley	Bagels
Broccoli	Bog beans	Breakfast cereals	Baked beans
Brussel sprouts	Broad beans	Granola	Bean salads
Cabbage	Chickpeas	Oat bran	Chili
Carrots	Field beans	Oat flour	Lentil soup
Cauliflower	Lentils	Pistachios	Pasta
Corn	Lima beans	Rice bran	Peanut butter
Cucumbers	Mung beans	Rye	Soy milk
Leeks	Peanuts	Sesame flour	Split-pea soup
Lettuce	Peas	Sorghum, grain	Stir-fried vegetables
Onions	Pinto beans	Sunflower flour	Stuffed cabbage
	Red kidney beans	Wheat bran	Tofu
	Soybeans	Whole wheat flour	Whole grain breads

The RFOs are fairly wide-spread in the plant kingdom, being found in a large variety of seeds from many different families. They rank second only to sucrose in abundance as water soluble carbohydrates. The relative abundance of raffinose, stachyose and verbascose in plants relates to the foods listed in the Table: *Foods Associated with Flatulence*.

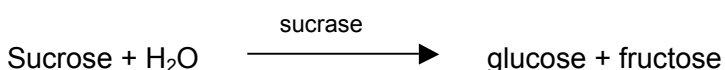
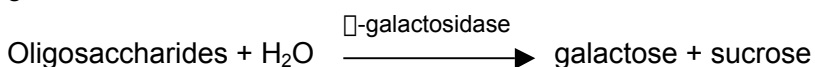


The following enzymatic chart illustrates the biochemical pathway.



Experimental Background:

Stock solutions were prepared for each group of research students by soaking ~50g of raw RFO containing produce, which were selected from the Table: *Foods associated with Flatulence*, with 100mL of deionized water at 25 °C for 12h. Each of these stock solutions served as the initial stock substrate $[S]_0$ solution that was incubated with active enzymes: β -galactosidase and sucrase, which are contained in *Beano*. They produce glucose and fructose.



The following procedure was followed.

Procedure:

5mL of a stock solution was pipeted into a labeled glass vial, $[S]_0$. A second 5mL aliquot was pipeted into one of the volumetric flasks *Labeled #1* and diluted with deionized water to 10mL. 5mL of this diluted substrate solution was pipeted into a second volumetric flask *Labeled #2* and diluted with deionized water to 10mL. The remaining 5mL of the first volumetric *Labeled #1* was placed in a labeled vial: $0.5[S]_0$. 10mL of the second volumetric *Labeled #2* was placed in a labeled third vial, $0.25[S]_0$. The vials were sealed with caps and placed in a constant temperature water bath for 20-30 minutes at the designated temperatures. Using a micro syringe, 10 μ L of liquid *Beano* to each vial was added and the time recorded. The vials were replaced in the constant temperature bath and one drop from each substrate vial tested every 5-10 minutes (recording the exact time) over a period of 40-50 minutes using the *Glucometer Elite* test strip and the readings recorded.

At the end of the test period, a few drops of 3M $\text{HCl}_{(\text{aq})}$ were added to vial $[S]_0$ which was placed in the constant temperature bath for ~5min, then tested and the reading recorded.

Glucometers are used by diabetics to monitor their blood sugar levels. They are calibrated for blood chemistry and not for simple aqueous solutions. Therefore, using the calibration graph that follows, convert the *Glucometer Elite* data readings in the Tables to respective concentrations of glucose and enter the respective values in the column on the right of the Table. Graph the concentrations versus time on a separate graph for each of the sugar sources, include different temperature and/or concentration trials on the same graph for each sugar source. Answer the Lab questions.